

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



Europäisches Patentamt
European Patent Office
Office européen des brevets



Publication number: **0 531 247 A1**

12

EUROPEAN PATENT APPLICATION

Application number: 92610065.2

Int. Cl.⁵: **F16H 25/20, F16H 57/04, F16H 1/14**

Date of filing: 04.09.92

Priority: 04.09.91 DK 1552/91

Date of publication of application:
10.03.93 Bulletin 93/10

Designated Contracting States:
BE CH DE ES FR GB IT LI NL SE

Applicant: **LINAK A/S**
Smedevaenget 8, Guderup
DK-6430 Nordborg(DK)

Inventor: **Jensen, Bent**
Smedevaenget 8, Guderup
DK-6430 Nordborg(DK)

Representative: **Pedersen, Soeren Skovgaard**
c/o K. Skoett-Jensen Patentingenioerer A/S,
Lemmingvej 225
DK-8361 Hasselager (DK)

54 Linear actuator.

57 In linear actuators, where the spindle device (6) is driven via a toothed gearing comprising two bevel gears (10, 12), it proves difficult to maintain a satisfactory greasing of the two gears. The grease is "cut" off the gears relatively soon. The solution to this problem is to completely contain the gears in-

side their respective, separate chambers between tightly limiting surfaces, at least at the gear rim area, such that the grease be retained in this area and be forcibly applied on the gear rim to effect the greasing.

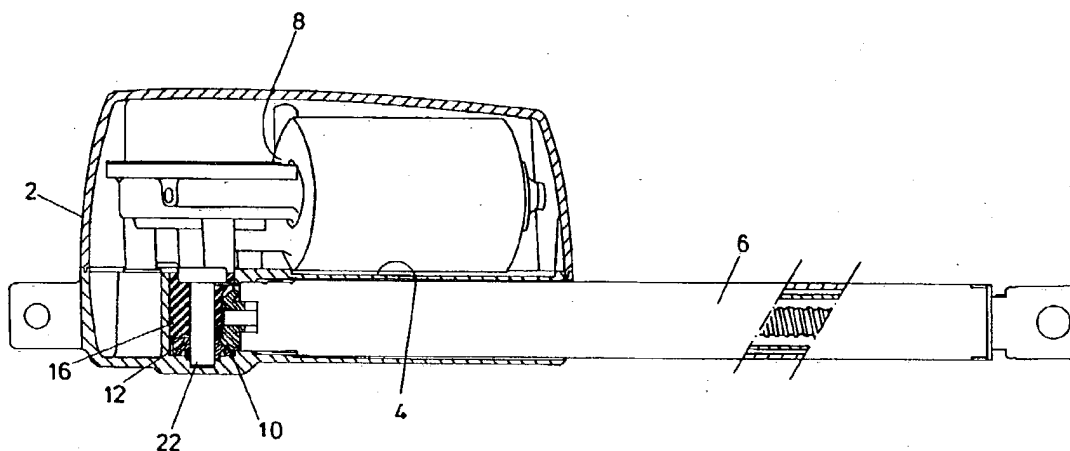


FIG. 1

EP 0 531 247 A1

The invention relates to a linear actuator comprising a spindle device driven via a toothed gearing having two bevel gears, where the transmission shaft is engaging one gear and the spindle the other one.

It proves difficult in a simple manner to ensure greasing the gears. The gears have been greased from the factory with an antinoise grease, but this tends to be "cut" off the gears at a relatively early stage, resulting in metal grinding against metal and the gears consequently soon be worn down. The heavier the loads that the actuators be subject to, the sooner the shearing of the grease takes place and that at a time when greasing is most vital. Furthermore the centrifugal force itself causes the grease to be thrown off the gears, and the gravitational force likewise tends to make the grease run off.

The object of the invention was simply to find a constructively simple and inexpensive solution to ensure greasing of the gears during the entire service life of the actuator, including it being subject to heavy loads. This is achieved by a solution according to the invention where the gears at least at the gear rim area are fully contained inside their individual chambers between snugly limiting surfaces such that the grease be retained in this area and be carried along on the gear rim, this being the correct place for performing said application of grease. The grease is so to speak forcibly supplied from one gear to the other where these are entering into engagement with one another. By applying grease of an antinoise nature the actuator will consequently retain a low noise level all its service life, this being of significance. Field experiments have proved that a construction according to the invention offers a service life of twice the usual for the gears. Further features of the invention are disclosed in the subsequent claims.

The actuator according to the invention will be described in further detail in the following with reference to the attached drawing illustrating an embodiment. The drawing illustrates as follows:-

Fig. 1 illustrates a longitudinal section through the actuator,

Fig. 2 illustrates the lower portion of the actuator casing seen from above, and

Fig. 3 is a perspective view from beneath of the infilling element.

The actuator comprises a casing 2 consisting of a lower and an upper portion having an internal tube-formed portion 4 in the lower portion in which a spindle device 6 is embedded. The upper portion of the casing accommodates an electric motor 8 integral with a mitre gear for driving the spindle via a toothed gearing consisting of two bevel gears 10, 12. The bevel gear 10 of the spindle device, i.e. the gear at the end of the actual spindle is attached to

and protrudes from the end of the tube-formed portion 4 and the bevel gear 12 of the transmission shaft, i.e. the gear at the end of the transmission shaft 22 of the transmission unit is in engagement with the former at the lower side. The gears are contained inside a compartment 14, where the shape of the bottom corresponds to the lower side of the toothed gear. The lateral limits of the compartment are constituted of the tube-formed portion 4 containing the spindle device, and opposite to this a semicircular wall narrowly encircling the circumference of the transmission shaft gear as well as a straight section of wall at either side continuing the curved wall as tangents to connection to the end of the tube-formed portion of the spindle device. Inside the compartment is detachably inserted an infilling element 16, the lower end of which has a shape that corresponds to the upper side of the transmission gear, and the flat side of said element facing towards the spindle device having a shape that corresponds to the shape of the spindle gear. The gears are thus contained inside their separate chambers 18, 20 having the surfaces tightly against the gear rims such that the grease is retained on the rims eliminating any possibility of shearing the grease even in cases of heavy loads. The infilling element 16 has a recess to accommodate the transmission shaft 22. The element is detachably placed down into the compartment and is retained in position by the motor unit that is being supported by the compartment wall and has screws securing it to the three pillars 24 in the lower portion. The element 16 consequently also retains the gears in their positions.

It should be realized that the above only serves as an example of an embodiment and that the invention as specified in the following claims can have a variety of actual embodiments.

40 Claims

1. A linear actuator comprising a spindle device (6) driven via a toothed gearing (10, 12) where the transmission shaft (22) be in engagement with one bevel gear (12) and the spindle (6) with the other bevel gear (10), characterized in that the bevel gears at least in the gear rim area are totally contained inside their respective, separate chambers (18, 20), where the walls are in intimate contact with the gears, and where the chambers exclusively are in connection with one another via the mutual engagement of the two gears, whereby the grease is retained on the gears and forcibly applied with these, during running.
2. An actuator according to claim 1, characterized in that the chambers (18, 20) for the gears are

designed in a separate element (16) coupled to the actuator casing (2).

3. An actuator according to claim 2, characterized in that the limit of one chamber (18) is constructed in a planar lateral face of the separate element (16) and that the limit of the other chamber (20) is constructed in an end face of the separate element.
5
10
4. An actuator according to claim 3, characterized in that a compartment (14) is constructed in the actuator for accommodating the separate element (16) where the support face of the bevel gear (10) of the spindle constitutes part of the lateral wall of the compartment and where the support face for the driven bevel gear (12) constitutes part of the floor or ceiling of the compartment.
15
20
5. An actuator according to claim 4, characterized in that the support face for the bevel gear (10) of the spindle is constituted of the end of the tube-formed portion (4) of the spindle device and that the lateral wall of the compartment from there encircles the driven bevel gear (12) in intimate contact with its circumference, and that a continuous recess for the transmission shaft (22) is incorporated in the element (16).
25
30
6. An actuator according to claim 5, characterized in that the height of the element (16) is adapted to reaching the upper edge of the compartment (14) and is retained by the electric motor (8) being mounted above the compartment.
35

40

45

50

55

3

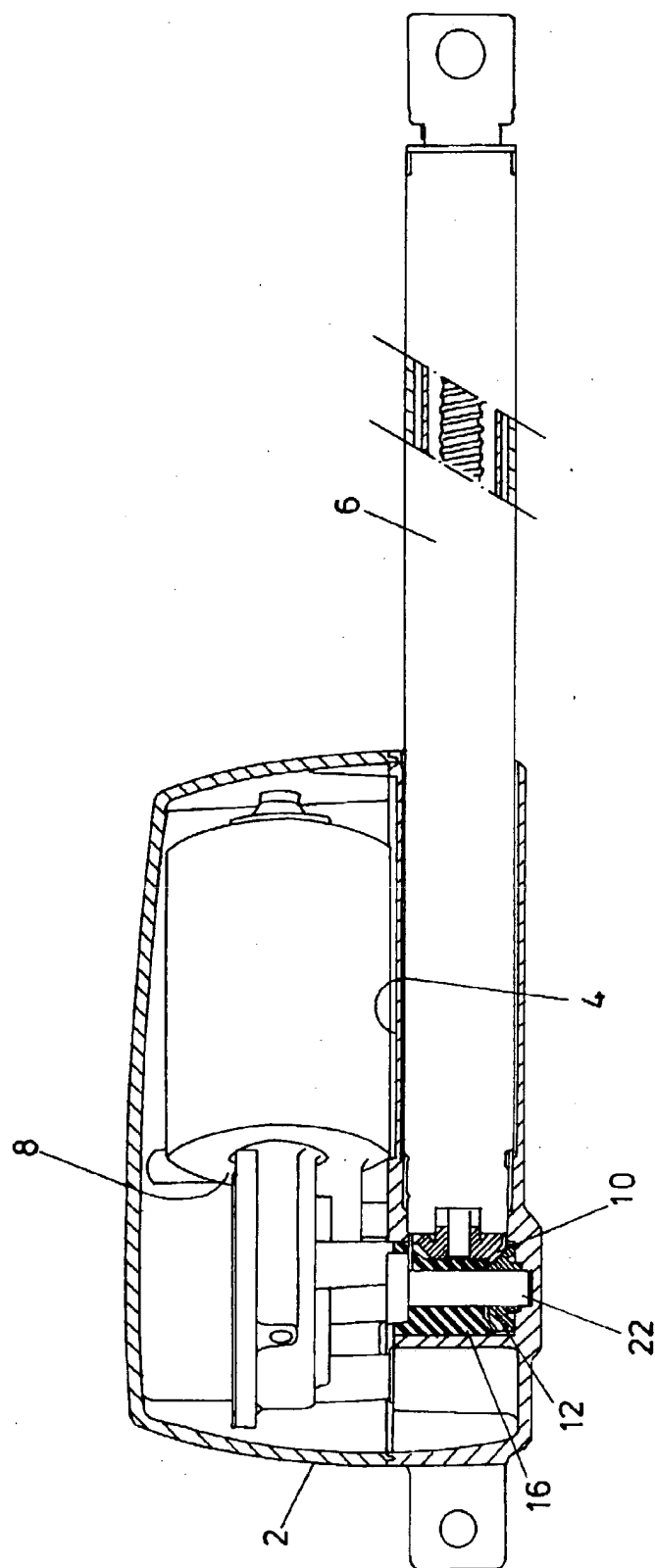


FIG. 1

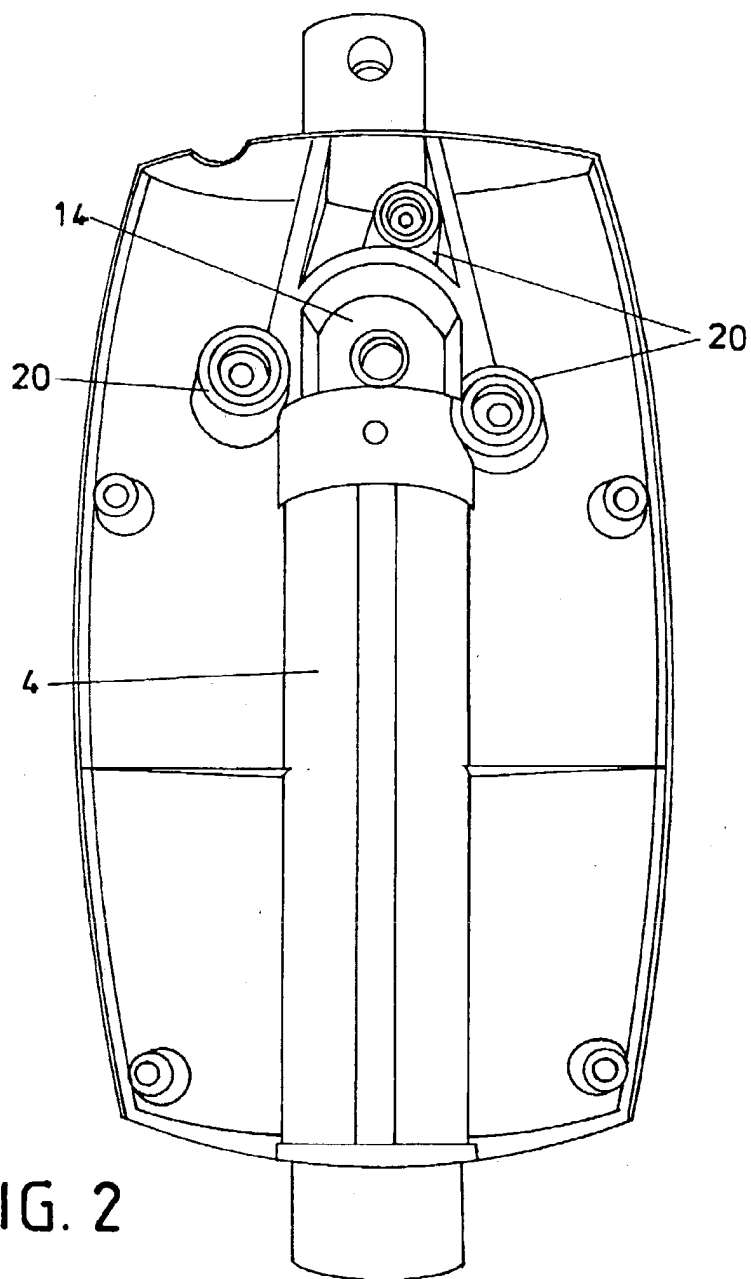


FIG. 2

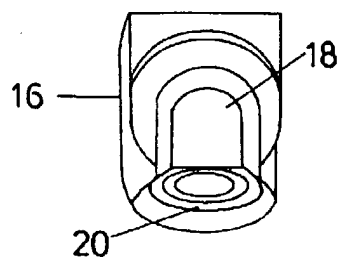


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 61 0065

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-2 595 780 (EGUI JULIA) * abstract; figure 1 * ---	1	F16H25/20 F16H57/04 F16H1/14
A	FR-A-2 503 326 (COOPER INDUSTRIES) * claim 1; figure 1 * ---	1	
A	GB-A-2 223 819 (ROLLS-ROYCE) * abstract; figures * ---	1	
A	US-A-5 018 407 (HOECHT) * abstract; figure 3 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F16H F16N H02K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 DECEMBER 1992	Examiner MENDE H.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

EPO FORM 1501 (P0401)